

Water Flow Vibration Effect

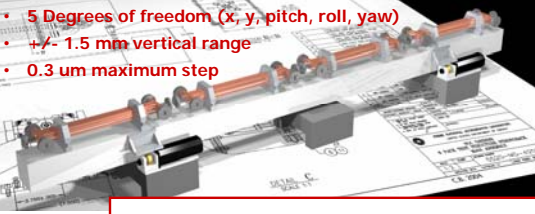


on the NLC RF Structure-girder System

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NLC Girder Specifications:

- 5 Degrees of freedom (x, y, pitch, roll, yaw)
- +/- 1.5 mm vertical range
- 0.3 um maximum step

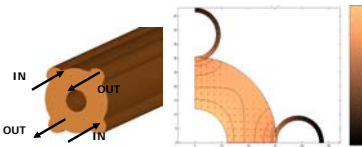


In order to apply beam based alignment, both the quads and the RF system must be supported by movers. The basic cell for the Main Linac RF system consists of 4 RF structures aligned on a girder that moves as a unit with 5 degrees of freedom.

Abstract

As part of the vibration budget study for the NLC Main Linac components, the vibration sources in the NLC modules (Girder) are under investigation. The activity is focused on the effect of cooling water flow on the structures (FXB type) stability, the transmission of vibrations to the adjacent components, and the effect of different materials of construction used for the supports. Experimental data and ANSYS simulations have been compared. This paper reports on the ongoing work.

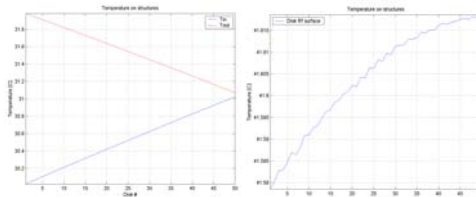
Water Cooling System



The RF structures are cooled by means of 4 water pipes connected as 2 parallel circuits each of them consisting in a counterflow configuration.

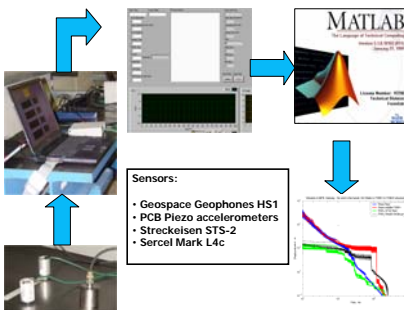
The optimal working temperature of the RF structures is around 45 C. Assuming the heat load and the cooling system parameters reported in the table above, it is possible to define the temperature at the RF wall and its distribution along the disk cross-section.

Input RF Power [W]	3500
Inlet Water Temperature [C]	30
Outlet Water Temperature [C]	32
Water Temperature rise [C]	2
Cooling tube ID [mm]	1.578
Water velocity [m/s]	1.059
Total Flow [l/s]	0.419
Reynolds Number (30 C)	20974
Prandtl Number (30 C)	5.4162
Film coefficient [W/m ² K] (30 C)	5025



The plots on the side show the temperature distribution of the water in each of the two cooling circuits of the RF structures and the mean temperature at the RF wall of the structures.

Vibration Measurements Setup



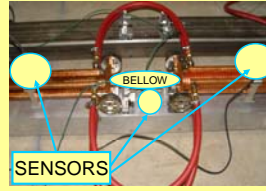
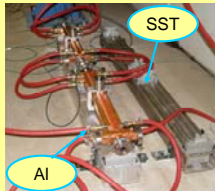
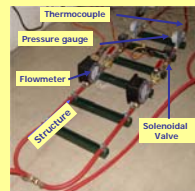
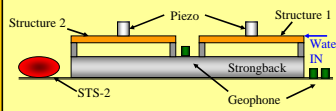
- Sensors:
- Geospace Geophones HS1
 - PCB Piezo accelerometers
 - Streckelsen STS-2
 - Sercel Mark L4c



The vibration experiments were performed in the Meson Area at FNAL. The setup was installed in a tunnel where the Low Conductivity Water is present. The scheme on the side describes the measurement procedure

SETUP 1

Two RF structures connected with a bellow, supported by a strongback either in Aluminum or in Stainless Steel to check the effect of the materials in the vibration transmission. The strongback is bolted on the floor. Cooling system: 2 circuit each of them applying counterflow with the two structures in series.



SETUP 2

Three RF structures connected with a bellow supported by a Aluminum strongback. The strongback is sitting on 5 mockup of mover as the NLC-Girder. A Permanent magnet is connected to the structures with a bellow.

Cooling System: 4 circuit in parallel with the structures in series.

